

ABSTRACT OF THE DISCLOSURE

A position sensor using a novel optical path array (OPA) element, an angle-selective spatial filter, and an imaging array is capable of measuring the translation and orientation relative to a target member in X, Y, Z, yaw, pitch, and roll ("6D") simultaneously, and with high precision. A target member includes an array of target points surrounded by a contrasting surface. The position sensor uses the OPA element in combination with the angle-selective spatial filter in a target point imaging arrangement such that the imaging array of the position sensor only receives light rays that enter the OPA element according to an operable cone angle α . Accordingly, each target point generally produces a ring-shaped image having a size on the imaging array that varies with the Z position of each target point. The X-Y position of each target point image on the imaging array varies with the X-Y position of each target point. Accordingly, three or more target point images analyzed in the same image are usable to determine a 6D measurement relative to the target member. X and Y displacement of the target member can be accumulated by known methods and the other 6D measurement components are absolute measurements at any position.